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13. ABSTRACT (Maximum 200 words)

SEVEN EXPERIMENTS WERE CONDUCTED UNDER THE OBJECTIVE OF TESTING OF PRECIPITATE FORMATION EFFICIENCY OF AIR, OXYGEN, AND OXYGEN OZONE; ESTIMATE THE TURBIDITY PRODUCED BY OZONATION OF THE SUPERNATANT OR FILTRATE. HYDROGEN PEROXIDE WAS INCLUDED IN SOME SMALL SCALE EXPERIMENTS. INCLUDED WITH THE REPORT IS A CHART ON THE SCHEDULE FOR PROCESS DEVELOPMENT, SOURCE TREATMENT SYSTEM DEVELOPMENT AND ANOTHER GRAPH ENTITLED MANGANESE HYDROXIDE SEDIMENTATION AT 640 F AND PH10, WELL 118 WATER CARBON TREATED.

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PROGRESS REPORT

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81356R69

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CONTAMINATION CONTROL DIRECTORATE
Rocky Mountain Arsenal
Commerce City, Colorado 80022

81356R69
original

Research Services for

Waterways Experiment Station
Vicksburg, Mississippi 39180

Supporting Program Under ITARMS Task No. 1.05.11

Consisting of

Design of the Precipitation and Sedimentation Stage for Conditioning Water
from Well 118 Prior to UV Ozonation

(See Test Plan Dated January 1978 for ITARMS Task No. 1.05.11 by Waterways
Experiment Station)

March 1978

H. L. Lawless, Process Development & Evaluation, RMA

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PROGRESS REPORT

METHODOLOGY:

Objective 1. is the testing of precipitate formation efficiency of air, oxygen, and oxygen ozone; estimate the turbidity produced by ozonation of the supernatant or filtrate. Hydrogen peroxide was included in some small scale experiments.

Under objective 1 - The following experiments have been conducted:

Experiment No. 1: Estimate of time to saturate tap water in settling tank with air:

A plastic reactor $.706 \text{ ft}^2$ by 5 ft high was equipped with air pump and three diffusers. Nitrogen was bubbled through the diffusers for 4 hours. Air was then pumped through the diffusers at $4.8 \text{ ft}^3/\text{min}$ (measured at 62°F and 628 mm over water as it discharged from the reactor vent). Flow/ ft^2 is $6.8 \text{ ft}^3/(\text{hr-} \text{ft}^2 \text{ of surface})$.

DATA FROM EXPERIMENT NO. 1

<u>Sample No.</u>	<u>Dissolved Oxygen (ppm)</u>	<u>Elapsed Hours</u>	<u>Reactor Temp</u>	<u>Gas Sweep</u>
7	6.6	0	0	--
1	1.6	4	54°F	4 Hrs N_2
2	7.3	0.25	62°F	Air
3	7.8	0.75	62°F	Air
4	7.8	1.25	62°F	Air
5	7.8	1.75	62°F	Air
6	7.7	2.75	62°F	Air

CONCLUSION:

Reactor was saturated with oxygen in 15 minutes. Pump has adequate flow rate.

Experiment No. 2: Estimate effect of temperature, pH, and % Hydrogen Peroxide (HP) on dependent variables below. Reasoning is that aeration would volatilize a significant quantity of organics contained in Well 118 water while HP oxidation would avoid the problem.

DATA FROM EXPERIMENT 2 (5 DAYS RUN TIME)

	50°F				150°F			
	pH=7.6		pH=10.6		pH=7.0		pH=10.8	
	0% HP	.05% HP	0% HP	.05% HP	0% HP	.05% HP	0% HP	.05% HP
Y_1 =Filterable Res. (%)	.978	.946	.882	.879	.935	.914	.930	.907
Y_2 =Non-Filterable Res. (ppm)	70	80	2160	2080	380	460	3140	3020
Y_3 =Iron (ppm)	0.22	.05	.05	.05	.11	.073	.073	.068
Y_4 =Manganese (ppm)	34.6	27.2	0.13	.05	2.03	2.38	.05	.05
Y_5 =% HP	.001	.001	.001	.001	.001	.001	.001	.001
Y_6 =Extractable Organics (ppm)	22.2	24.4	12.9	19.2	12.1	16.5	8.6	11.6

Conclusions will be based on statistical analysis of the data. In general:

1. Iron was low in well water at 50°F, 0% HP, and pH 7.6. Air cushion in well tank may be responsible; nitrogen cushion being placed in tank.
2. Manganese is precipitated at higher pH; HP has some effect and heat aids precipitation.
3. Extractable organics show complex behavior but there is little indication of organics destruction by HP.

Experiment No. 3:

3-A Testing effect of nitrogen on volatilization of organics, filterable solids, and on iron and manganese precipitation. (The Fe/Mn data will be the baseline for aeration experiments).

3-B Aeration experiments using nitrogen treated Well 118 water -- measure loss of organics due to oxidation and precipitation of iron/manganese.

Samples in for analysis.

Experiment No. 4:

Oxygenation of above aerated water to compare air and oxygen.

Samples in for analysis.

Experiment No. 5:

Removed organic material from Well 118 water with activated carbon column.

Aerated and sampled to estimate iron, Mn, COD, and insolubles. Loss across carbon bed is to be estimated.

Samples in for analysis.

Experiment No. 6:

Oxygenation of water left from Experiment No. 5 (little or no precipitation seen).

Samples in for analysis.

Experiment No. 7:

Precipitation of manganese by increasing pH to 9.5. Will get preliminary sedimentation rate data from this.

This experiment is in progress.

Future experiments will involve ozone rather than air or oxygen. Want to avoid pH adjustment if possible. Will repeat some of above experiments. Sedimentation rate of ozone-formed precipitate will be measured.

4.0 PROCESS DEVELOPMENT -- SOURCE TREATMENT-SYSTEM DEVELOPMENT FY 78

JAN 78 -- SEPT 78

2 Feb 78

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4.1 UV/O ₃ - WELL 118												
4.1.1 WES Bench Scale												
4.1.2 WES Field Scale												
4.1.3 Iron/Manganese (RMA)												
4.1.4 Decomposition Products (WES)												
4.2 WELL 118												
4.2.1 Operate Full Process												
4.2.2 F Ion MERADCOM												
4.3 BASIN F												
4.3.1 Characterization (WES)												
4.3.2 Parallel Processes (RMA)												
4.3.2.1 Literature System												
4.3.2.2 Wet Air												
4.3.2.3 Electrolytic												
4.3.2.4 Oxidative												
4.3.3 By-Product Disposal												
4.4 PROCESS ECONOMICS												
4.4.1 Basic Physical Data												
4.4.2 Basic Process Data												
4.4.3 Basic Cost Data												

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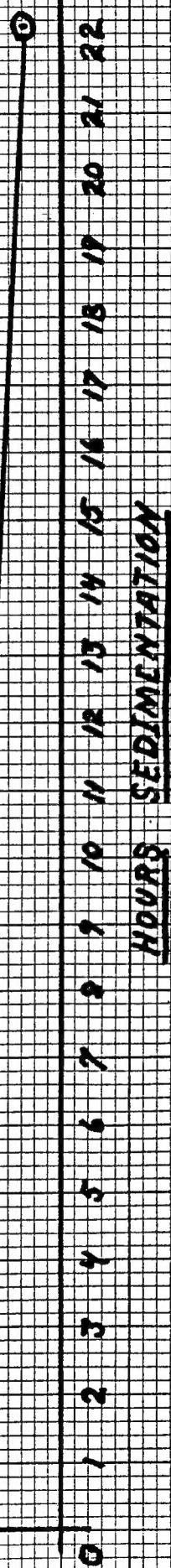
FIG. I

MANGANESE HYDROXIDE SEDIMENTATION AT 69 OF AND PH 10
VERSUS 1/8 WATER CARBON TREATED

54 INCHES

TOP OF SEDIMENT (% OF DEPTH)

NOTE: WEIGHT ABOVE TOP OF SEDIMENT
WAS CRYSTAL CLEAR



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